Energy Services Technician

practical training for a new job title

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City University of New York (CUNY)

New Ideas in Educating a Workforce for Renewable Energy and Efficiency
IREC Conference at Hudson Valley Community College, 3/20/2008
Overview of Presentation

• What is the job title “EST for buildings” and why is it so important now?

• Knowledge and Skill Areas

• Practical Exercises in the Curriculum
EST: A New Job Title

- **Not** an HVAC or Environmental Control Tech
- *More energy analysis* than equipment troubleshooting

Courtesy: Hampden Engineering Inc.

Great for HVAC, less so for EST
EST: A New Job Title

- Energy management
- Energy use analysis, facility energy performance monitoring & reporting
- System optimization, commissioning
- Energy project id, analysis and development

What the heck is this?
EST: A New Job Title

• Market demand for energy efficiency services
  – portfolio benchmarking, energy audits, design/build, commissioning services, M&V, maintenance services, “carbon reporting”
  – LEED for Existing Buildings
  – End-users, consultants, contractors, utilities

• Provide a marketable package of skills
EST: Fulfills an Urgent Workforce Need

• Energy efficiency in buildings represents a huge resource for carbon reduction

• Who will implement critical building energy efficiency projects?
  ….and make sure they run as intended over the long-term?

• Workforce as a supply constraint
EST - Potential Employers

- Engineering firms, Consultants, ESCO’s
- Product companies
  - BAS vendors
  - Solar installers
- Property Managers
- Outsource building services firms
- Utilities
Who are we educating & training as EST?
Two slightly different audiences

- **Present workforce** (building operators, maintenance staff, service technicians)
  - Upgrading skills, promotions, career ladders
  - Returning for degree

- **New entrants** (engineering, arch tech & enviro sci students, technical high school grads)
  - Little or no building experience
  - In degree program, career options
  - Importance of internships
EST KNOWLEDGE & SKILLS

• **Data Acquisition**
  – Historical energy use
  – Use of plans
  – Measurement & instrumentation & tools, readings, tests, sampling
  – Observation of systems, dynamics, opportunities

• **Analysis**
  – Synthetic skills - integration, interpretation
  – Calculation - energy loads, modeling, economic analysis

• **Communication**
  – Written reporting, verbal presentation
  – Teamwork, Interviewing
## EST KNOWLEDGE & SKILLS
### Academic Subjects

<table>
<thead>
<tr>
<th>Subject</th>
<th>Knowledge &amp; Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics</td>
<td>properties of materials, simple thermo</td>
</tr>
<tr>
<td>Chemistry</td>
<td>reactions, equations, combustion</td>
</tr>
<tr>
<td>Math</td>
<td>algebra, statistics, graphical analysis</td>
</tr>
<tr>
<td>Communications</td>
<td>verbal, written</td>
</tr>
<tr>
<td>Technology</td>
<td>spreadsheets, word-processing</td>
</tr>
<tr>
<td>Business</td>
<td>organizational concepts</td>
</tr>
<tr>
<td>Economics</td>
<td>market concepts, demand &amp; supply curves</td>
</tr>
</tbody>
</table>
EST KNOWLEDGE & SKILLS
Specific Job Performance Areas

• energy units, conversions
• energy data, data management, interpretation
• building characteristics
• mechanical and electrical system components & functions
• system & equipment testing, data acquisition
• energy efficiency measures & analysis
• modeling and equipment selection
### PRACTICAL EXERCISES

| Energy Units, Conversions | • Fuel price comparison - spreadsheet  
|                          | • Carbon footprint calculation  
| Energy Data, Data Management | • Compile a data set  
|                          | • Use a spreadsheet or db tool - benchmark  
| Building Characteristics | • Work with plan sets  
|                          | • Field measurements and drawing  
|                          | • Dimensional take-offs  
| Building System Components & Functions | • Draw system schematics  
|                          | • Read and develop sequences of operation  
|                          | • Simulations  
| Data Acquisition, Testing | • Use data loggers, conduct field tests, access BAS data  
| Energy Efficiency Measures & Analysis | • Define and calculate an EE project  
|                          | • Model and design a system replacement  

M.Bobker, CUNY        IREC RE and EE Workforce Development Conference         HVCC March 20, 2008
PRACTICAL EXERCISES

• The exercises avoid physical “lab” set-ups
• Use campus facilities and/or student’s workplaces
• Emphasize data skills and energy performance rather than equipment troubleshooting
• Understand energy process and outcomes
PRACTICAL EXERCISES
example of a simple calculation tool

<table>
<thead>
<tr>
<th>CALCULATING PRICE PER MILLION BTU</th>
</tr>
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<tbody>
<tr>
<td>electricity</td>
</tr>
<tr>
<td>unit</td>
</tr>
<tr>
<td>cost/unit</td>
</tr>
<tr>
<td>btu/unit</td>
</tr>
<tr>
<td>$/mmBTU</td>
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</tbody>
</table>

notes:
- electric btu value is site energy only
- fuel values only, does not take into account differences in efficiencies

- Teach fuel / energy values, prices
- Basic spreadsheet skills
PRACTICAL EXERCISES
Schematics & Sequences of Operation

- logical relationships between equipment elements
- fundamental fieldwork skill
- common for mechanical and electrical
- clarity of thought and presentation
PRACTICAL EXERCISES

energy data spreadsheet tools

- organizing data from individual bills or from utility websites
- public domain software – Wisconsin Focus on Energy -- or other - EPA EnergyStar Portfolio Manager

<table>
<thead>
<tr>
<th>Year*</th>
<th>therms/sf/yr</th>
<th>Therms</th>
<th>Cost</th>
<th>Heating</th>
<th>Cooling</th>
<th>Degree Days</th>
<th>$/therm</th>
<th>th/DD/10,000sf</th>
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<td>0</td>
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<tr>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>$0.0000</td>
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</table>

2003 as a % of 2002
na na na na na

2004 as a % of 2002
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*Years listed above are based on the twelve month period ending in Dec

Utility History

<table>
<thead>
<tr>
<th>Meter Read Date</th>
<th>Thperms</th>
<th>Cost</th>
<th>Degree Days</th>
<th>$/therm</th>
<th>th/DD/10,000sf</th>
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<tbody>
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<td>Dec</td>
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Start entering your oldest billing data first.
PRACTICAL EXERCISES
energy data
spreadsheet tool

• graphical plots, trends
• normalization by degree-days
• baseline creation
PRACTICAL EXERCISES
Define & Develop an ECM Project

- Existing condition description
- Description of proposed measure(s)
- Energy Analysis
  - Assumptions
  - Method of Calculation
  - Measurement plan
  - Measure interactions
- Feasibility and Cost Estimate
- Economic Analysis
PRACTICAL EXERCISES
Model Alternatives in an HVAC Design

• Develop a schematic design for an HVAC replacement, following a summary program

• Use an energy modeling tool to compare alternative configurations, equipment selections
  – E-Quest is a popular free program that provides easy data inputs and graphical outputs for DOE-2 modeling engine

• Select and size equipment and show on a schematic plan set
PRACTICAL EXERCISES

Simulations

- Lab-on-a-desktop
- Equipment operation *but not energy use*

courtesy: SimuTech Systems Inc.
PRACTICAL EXERCISES

Advanced Simulators

- Energy model provides outputs to real digital controls or on-screen graphics. Response feeds back into model.

- Potential to show energy use outcomes of control and operating decisions
## Fitting Practice to Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Topics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building Systems-1</td>
<td>- Plans and building characteristics&lt;br&gt;- Schematics, mechanical &amp; electrical&lt;br&gt;- Simulations</td>
</tr>
<tr>
<td>Building Systems-2</td>
<td>- System design and modeling&lt;br&gt;- Write control sequences of operation</td>
</tr>
<tr>
<td>Energy Management-1</td>
<td>- Energy units &amp; conversions, fuel prices&lt;br&gt;- Energy data management, benchmarking&lt;br&gt;- ECM project analysis</td>
</tr>
<tr>
<td>Energy Management-2</td>
<td>- Project economic/financial analysis (LCC)&lt;br&gt;- ECM project analysis&lt;br&gt;- Report Preparation and Presentation</td>
</tr>
<tr>
<td>Energy Economics</td>
<td>- Energy Economics</td>
</tr>
<tr>
<td>Energy Management-2 (capstone)</td>
<td>- ECM project analysis&lt;br&gt;- Report Preparation and Presentation&lt;br&gt;- Carbon footprint calculation</td>
</tr>
<tr>
<td>Intro to EST and again in EM-2 (capstone)</td>
<td>- Intro to EST and again in EM-2 (capstone)</td>
</tr>
</tbody>
</table>
Conclusion

• Building EST knowledge / skill requirements can be matched to a set of practical training exercises

• Practical exercises can be delivered without large investment (of time and $$) in physical lab facilities

• Students will obtain a directly marketable package of skills
Thank you.
Questions?

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